PREFACE

External beam radiotherapy with ionizing radiation is one of the most vital modalities used for the cancer treatment. The cancer cells are more sensitive to ionizing radiation in comparison to the normal cells which establishes the radiobiological basis of the radiation therapy. Treatment techniques used in the management of malignant diseases (cancer) share the common objective: that is to deliver highest possible radiation dose to the targeted area containing cancer cells and the lowest possible dose deliver to the organs at risk (OAR) to reduced normal tissue complications. To achieve this objective it is important to have a good understanding of the dose distribution delivered by the radiation beam which is mostly produced by telegamma units (Linear accelerator, Telecobalt unit). In the recent past the uses of Monte Carlo methods have became very vital for computing the dose distribution delivered by the radiation since it is superior to the empirical and semi analytical methods that are used in the clinics for dose calculations. The dose calculation algorithms used in commercially available treatment planning systems are applying several approximations that can lead to errors in the computed dose delivered by the radiation beam. Monte Carlo methods have improved accuracy in calculating the dose delivered by the radiation beam as these methods do not use any such approximations for computation of dose distribution but these methods take large computation time. The advance in computer technology have provided very fast computers at economical cost and therefore the use of Monte Carlo methods in radiotherapy has became a reality. Monte Carlo methods are simulation tools used in radiation therapy to simulate the deposition of the radiation energy in the absorbing medium and are the most accurate approach to calculate the dose delivered by the radiation beam. These

methods provide a very potent and efficient way of determining the dosimetric and spectral characteristics of radiation beam.

Thus in our research work entitled as "**Monte Carlo Based Simulation Analysis of Flattened and Unflattened Photon Beams used in Radiotherapy"** we have developed an accurate Monte Carlo simulation model for 6 MV photon beam produced by Varian Clinic 600 linear accelerator (unique performance model) available at our institute by benchmarking the various dosimetric parameters estimated using our simulation model with experimentally measured data. In this study we have used our simulation model to investigate the dosimetric and spectral characteristics of both flattened and unflattened beam.